PCT/EP2004/050359

15 APR. 2004

INVESTOR IN PEOPLE

EP04/50359

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NP10 8QQ

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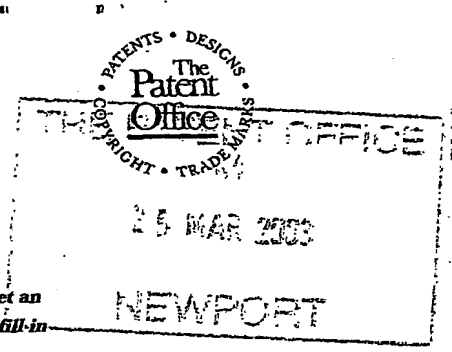

25MAR03 E794797-9 D00350
P01/7700 0.00-0306769.1

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road
Newport
South Wales
NP10 8QQ

1. Your reference

MG/LD/P/22686.GB

2. Patent application number
(The Patent Office will fill in this part)

25 MAR 2003

0306769.1

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

VOITH FABRICS HEIDENHEIM GmbH & CO. KG,
KURZE STRASSE 11,
89522 HEIDENHEIM,
GERMANY.

Patents ADP number *(if you know it)*

7841125002

If the applicant is a corporate body, give the country/state of its incorporation

GERMANY

4. Title of the invention

COMPOSITE PRESS FELT

5. Name of your agent *(if you have one)*

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

WILSON GUNN M'CAW
41-51 ROYAL EXCHANGE
CROSS STREET
MANCHESTER
M2 7BD

Patents ADP number *(if you know it)*

7153927001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

YES

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	11
Claim(s)	
Abstract	
Drawing(s)	1+1

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature Wilson Gunn M'Caw Date 24.03.2003.

12. Name and daytime telephone number of person to contact in the United Kingdom M. GOODWIN - 0161 827 9400

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Notes

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COMPOSITE PRESS FELT

The present invention relates to a press felt for use in the press section of a papermaking machine.

Paper is conventionally manufactured by conveying a paper furnish, usually consisting of an initial slurry of cellulosic fibres, on a forming fabric or between two forming fabrics in a forming section, the nascent sheet then being passed through a pressing section and ultimately through a drying section of a papermaking machine. In the case of standard tissue paper machines, the paper web is transferred from the press fabric to a Yankee dryer cylinder and then creped.

Papermachine clothing is essentially employed to carry the paper web through these various stages of the papermaking machine. In the forming section the fibrous furnish is wet-laid onto a moving forming wire and water is encouraged to drain from it by means of suction boxes and foils. The paper web is then transferred to a press fabric that conveys it through the pressing section, where it usually passes through a series of pressure nips formed by rotating cylindrical press rolls. Water is squeezed from the paper web and into the press fabric as the web and fabric pass through the nip together. In the final stage, the paper web is transferred either to a Yankee dryer, in the case of tissue paper manufacture, or to a set of dryer cylinders upon which, aided by the clamping action of the dryer fabric, the majority of the remaining water is evaporated.

A conventional press fabric comprises a batt of fibres needled to a base fabric.

US 4,847,116 and US 4,571,359 relate to press fabrics in which a uniform layer of polymeric resin particles is applied to the surface of a woven textile base fabric. The resin particles are fused together to provide a porous elastic surface layer. A similar arrangement is described in EP 0653512A except in that a reinforcing structure, possibly a press felt, comprising a base cloth and a fibrous batt, is entirely embedded within the fused particulate material. These methods, involving sintering of fused particles, have limitations in practice as it is difficult to apply a large mass of particles of the required large particle size, to a substrate and achieve controlled placement, porosity and application thickness.

US 4,772,504 describes a substantially impermeable press felt, provided with a layer of plastics material on the paper contacting surface to act as an anti-rewet layer.

US 6,017,583 relates to a process for the manufacture of a permeable strip material in which a plastics layer comprising soluble corpuscles is applied to a support and the soluble corpuscles are then leached out to provide through-flow passages. The plastics layer is initially applied as a powder and forms a planar outer surface plastic layer by heat and pressure treatment.

GB 2,200,687 describes the addition of additives to the needled batt layer of press felts in order to maximise the coated area between the press felt and the paper web. Such felts, when in use, are prone to rapid wear and a drastic reduction in felt porosity.

US 4,357,386 relates to a papermaker's press felt made up of a textile base layer, an intermediate layer of polymeric resin foam particles and a covering layer of non-woven staple fibres. The foam particles are included to improve wear and

delamination, as well as to increase water removal capabilities. These particles, which are 0.3 to 2cm in diameter are not melted but are instead consolidated into the felt by needling.

EP 0987366A2 relates to a press felt in which a fibrous batt is needled to a woven base fabric. A substantially smooth and substantially uniformly porous layer is applied to the batt. This layer may comprise a woven fabric, a porous film sheet or a porous film obtained by heating a layer of at least partially fusible powder material.

According to the present invention there is provided a press felt comprising a batt of fibres optionally needled to a base cloth, characterised in that during manufacture of the press felt a dispersion of particulate, polymeric material is thermally activated to provide a discontinuous surface layer containing a mixture of batt fibres and a polymer-batt fibre matrix.

The thermal activation may comprise, for example, heating or applying incident radiation.

The resin-batt fibre matrix would comprise batt material at least partially impregnated with polymer.

It has been discovered that a significant impact on the fibre web structure can be realised using this technology with relatively small quantities of particles (1% to 5% weight add on). This is important in providing process consistency, and is also much more cost effective than prior art methods. Multiple applications using relatively small amounts of particulate material in each pass, may be used to provide uniformity of surface. The cost of the material is an important

consideration as one preferred particle is an elastomeric polyurethane, which is expensive to grind to the small particle sizes required.

Surprisingly, the press felt of the invention exhibits excellent resiliency and a smoother more planar and uniform pressing interface for the paper web, particularly when under pressure, for example at a press nip.

The press felt of the invention further exhibits excellent wear resistance, pressure uniformity, and air and water permeability. Press felts in accordance with the invention further exhibit excellent batt fibre bonding.

The press felts may be made by depositing particles of polymeric material, optionally in combination with one or more binding agents, viscosity modifiers, anti-settling agents and/or wetting agents, onto the fabric surface. The water is removed whilst the binder holds the particles in position. The modified surface is then heated in order to soften the particulate matter, whereupon the particulate material undergoes at least partial flow and fuses to itself as well as to the batt fibres and any inorganic matter in the vicinity. The resulting partially fused surface layer may then be calendered. In the case of an elastomeric polyurethane, the particles will thermally bond to each other and to the batt fibres, but will not flow spontaneously, and consequently flow channels and porosity are maintained in the press felt structure and on its surface.

The particles are ideally supplied as a suspension in a liquid, preferably water. The polymeric dispersion is preferably applied by a kiss roll or as a foam in which case a foaming agent is included in the formulation. Blade coating/spray techniques may also be used.

According to a second aspect of the present invention there is provided a method of making a press felt in which a dispersion of particulate, polymeric material is applied to a batt of fibres, the batt being optionally needled to a base cloth, the particulate material then being thermally activated to bond the particulate material to the press felt and provide a discontinuous surface layer containing a mixture of batt fibres and a polymer-batt fibre matrix.

The method of the invention may be used to introduce any particulate (organic and/or inorganic) matter to a press felt. Organic and/or inorganic matter could be mono/poly dispersed in the particulate matter, as could micro-fibres, bicomponent and/or splittable fibres, carbon fibres, nano-particles, alloys or blends of polymeric materials, and/or hollow micro-spheres. The polymeric material may be thermoplastic or thermoset. Multiple particle sizes and/or multiple types of particles having different hardnesses and melting points may be used to create unique surface and drainage effects. Additional micro-fibres are preferably added to the particulate material in that they aid bonding and they give the structure multi-directional strength and so reinforce the structure by enabling the layers of particulate matter to become more securely bonded to one another and to the batt fibres. The micro-fibres may be selected to have complex surface striations/morphology and may have a selected material property so as to facilitate wicking of moisture away from the paper web. This might also be achieved with a surface network or with micro-particles. Inorganic materials may be useful for static control and in providing sensor triggers for on-machine monitoring devices. Very hard or conductive inorganic particles, or time release capsules (such as are

described in US 4,569,883) with surfactants or tracer material, etc. can be added utilising this technology.

The polymeric material preferably comprises at least one of polyurethane or a co-polyamide. These particles will disperse and penetrate into the batt structure depending on the selected batt fineness and stratification, particle sizes and concentration, dispersion viscosity and temperature.

From 1 to 5% weight add on of polymeric material is preferably applied. This is insufficient to form a continuous sheet layer. We would estimate that 20% weight add on would be required to form a sheet layer.

The diameter of the particles of the polymeric material is ideally in the range from 1 to 300 microns, preferably 80 to 100 microns.

The dispersion ideally comprises a binder to hold the particles in place on the felt although if co-polyamide is used as the particulate material, a binder is not required.

Bonding to the batt fibres is achieved via the binder system. The binder could be in liquid or solid form. The binder might be a permanent chemical adhesive. The binder is preferably included in an amount of 0.1 – 0.5% of the dispersion volume. If the binder is in particulate form, then its melting point should be lower than that of the other particles and of the, typically polyamide, batt fibre. Preferred binders include any of the following either alone or in combination:- co-polyamides, co-polyesters, PVA's, PU's and nitrile latex rubbers.

The particulate dispersion ideally comprises a viscosity modifier to suit processing methods and equipment. Preferred viscosity modifiers include any of

the following either alone or in combination:- Neutonian, Pseudo-plastic and/or strongly pseudo plastic types, based on PU, acrylic or PA's for water-borne systems. Guar and natural gums can also be used. Commercial viscosity modifiers include Tafigel PUR 61, Tafigel PUR 50 (Tafigel is a trade mark of Munzing Group), Drewthix 6050/4025 (Ashland Chemical Speciality), K Stay 731/720 (King Industries) and Rheolate RH 212 (Rheox Inc.).

The particulate dispersion may include one or more anti-settling agents. Examples of anti-settling agents for water-borne systems include – DISPARLON® AQ-607/610 based on amine salts of polyamides, Edaplan 480 – Polyacrylic based system (Munzing Group) and Efka 4550 and 4520 – PU based systems (EFKA Additives BV). The particulate dispersion preferably comprises from 0.1 – 2% of anti-settling agent and, more preferably from 0.2 –0.25%.

The particulate dispersion may also include one or more wetting agents. Examples of suitable wetting agents include any hydrocarbon, silicone and/or fluorine containing surfactants e.g. Alkanol 6112 (Ciba Speciality Chemicals Corp.) and Coatosil 1211 (Osi Inc.). The wetting agent is added in order to improve the surface pick-up by lowering the surface tension of the felt surface.

Typically, any type of endless or seamed base can be used as the substrate. Alternatively, it may be the case that the combination of the binding particles and the polyamide nonwoven fibres alone may provide sufficient strength and stability, so that a standard textile type base can be omitted.

Particles bonded to the surface of typically round fibres and yarns may provide surprising influences on improving or controlling water or air flow and/or

sheet release at extremely high speeds anticipated for newer generation of paper machines.

In a preferred embodiment of the invention a complex, unique composite matrix is created using a relatively coarse nonwoven staple fibre. These fibres are bonded together using relatively large polymeric particles for increased long-term resiliency and also improved fibre bonding and strength. Nearer the surface an application of finer, perhaps harder particles can be made, interbonded with each other, the polyamide fibres and the larger interior particles to form a resilient interconnected network with a high degree of overall uniformity on the pressing surface, while still providing excellent porosity for sheet dewatering, and a far tougher surface, immune to fibre shedding than is achievable with fine diameter staple fibres.

In order that the present invention may be more readily understood, specific embodiments will now be described with reference to the accompanying representations in which:-

Fig. 1 is an SEM of the surface of one press felt in accordance with the invention at 10X magnification; and

Fig. 2 is an SEM of the same surface at 20X magnification.

Example 1

A press felt was manufactured by needling a batt of polyamide fibres to a woven base cloth.

A particulate dispersion was prepared, the constituents of which are listed below.

9 g/l – Meypro gum (Guar gum)

5 g/l – nitrile latex – Sarpifan U706 (trade mark) as supplied by Stockhausen.

78.75 g/l – polyurethane particles (20-300 microns in diameter)

Water

The viscosity modifier, binder and polyurethane particles were added to the water to provide the particulate dispersion. The dispersion was then applied in a substantially uniform manner by a kiss roll. This was applied in multiple revolutions, leading to uniformity of the particulate matter within the felt/batt fibre surface. The treated fabric was then dried in order to drive off excess water, for example by hot air or infra-red radiation.

The treated fabric was then heated to the softening temperature of the polyurethane particles. Whilst the particulate material is in a quasi-molten state, the fabric surface was compacted using a compaction roll which pushed the material in to the interstices within the batt, whilst also smoothing the fabric surface. This results in a porous, composite with high resiliency and a smooth surface.

Tests have proven that the press fabric made in this way provides increased smoothness in the nip, thus reducing the possibility of marking of the paper web.

In the following examples a press felt was treated in like manner to Example 1.

Example 2

Dispersion formulation

1g/l – Coatosil 1211 - Osi Inc

100g/l – Estane 58810 (PU – 50-150μm)

2.4g/l – AQ 607 – King Industries

1.6g/l – AQ 610 – " "

5g/l – Tafigel PUR 50 - Munzing group

2g/l – Tafigel PUR 61 - " "

2.5g/l – UKA 8713 – Bayer

Water

Example 3

As e.g.2 without the Estane (i.e. no PU particles)

Example 4

As e.g. 2 using 50 μm Estane (instead of 50-150μm dispersion)

Example 5

As e.g. 2 using >150μm Estane (instead of 50-150 μm dispersion)

The above were all applied using a kiss roll applicator.

The photographs of Figs. 1 and 2 show that the particulate material is melted (and not sintered) and is present as a non-continuous treatment. The melted thermoplastic material fills the interstices between the batt fibres, whilst fusing around the batt. The treatment fills the undulations in the batt to give a

smoother and more planar surface, after calendering, which does not close down the permeability of the fabric.

It is to be understood that the above described examples may be subject to various modifications. Alternative viscosity modifiers, binders and particulate polymeric material may be used. The method of application may also be varied. For example, the particulate dispersion may be applied as a foam. In such circumstances a foaming agent may be required.

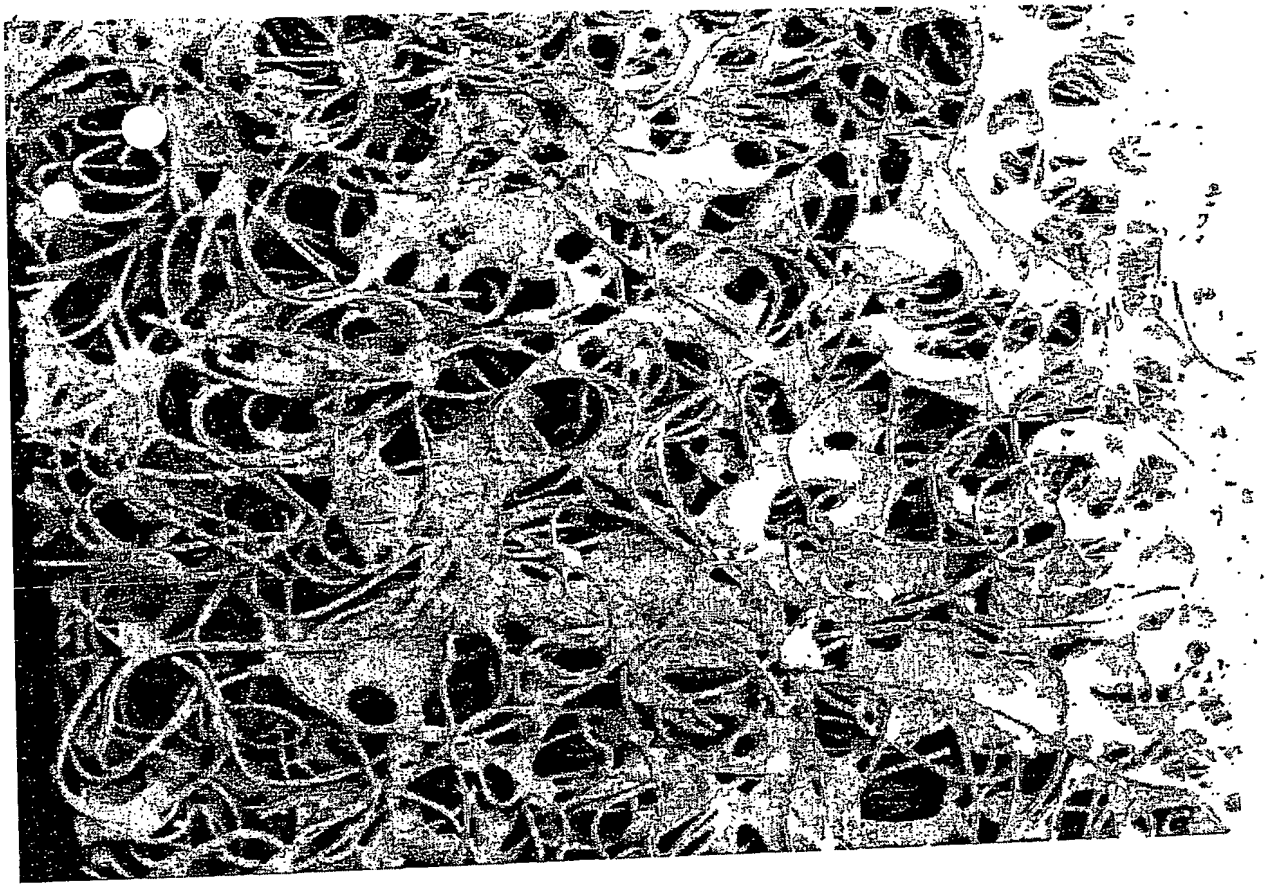

Fig 1

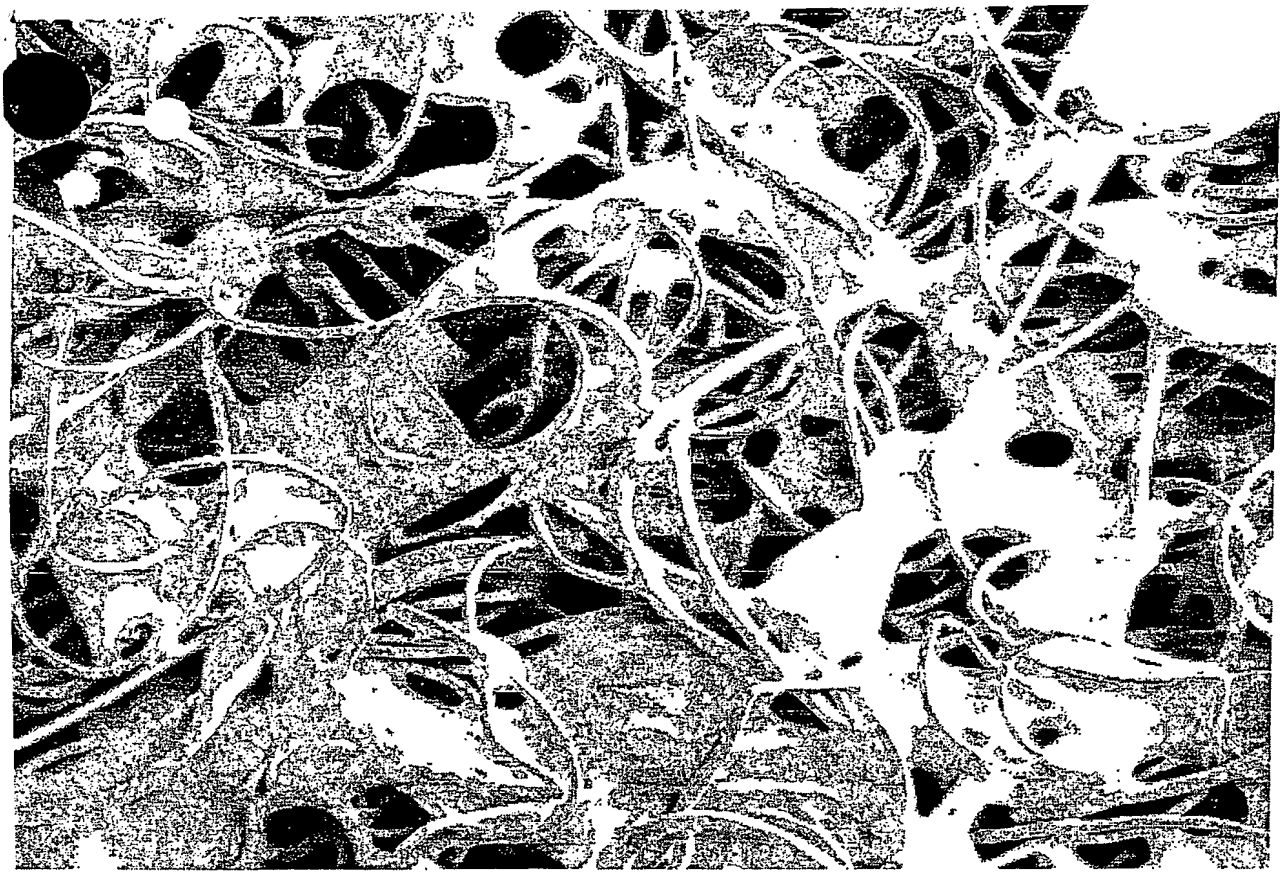

Fig 2